

solid state

A Balance Control for the Hafler DH-200

By Cornelius Morton

Make a classic even better . . . with this easy, inexpensive mod for this notable amp.

When David Hafler brought out the DH-200, it was a very good power amplifier at an exceptional price. It was simple, with good parts; the kit was easy to assemble; and the sound was good: 100W/channel loud and about as bullet-proof as an Abrams tank. There were a few warts though. Hafler cured a couple with the DH-220, adding a balance control and an inverting input to ease bridging, increasing the input impedance to 47k Ω .

To ensure acceptance, he added a few windings to the power transformer secondary winding so that the output voltage went from $\pm 60V$ to $\pm 65V$, increasing the rated power to

115W/channel. There are numerous available upgrades for both the DH-200 and the DH-220, with many costing more than the original unit. The DH-220 balance control was a major improvement over the 200.

A balance control generally requires new circuit cards at a cost of \$100–\$200 per channel. This article describes a balance control that allows each channel offset to be adjusted to $\pm 1mV$ for a cost of about \$12 and a couple hours of time.

OVERVIEW

Figure 1 shows the basic balance circuit. The two 33k Ω resistors and two 1N4148 diodes connect between the negative and positive 58V sources for the low-level circuits. The center junction of the diodes is grounded. A current of about 1.7mA flows through the 33k Ω resistors. A series combination of a 1k Ω resistor, a 1k Ω poten-

tiometer, and a 1k Ω resistor is connected across the two diodes. As the diodes maintain a voltage drop of about 635mV per diode, the voltage across the potentiometer is $-212mV$ at one end and $+212mV$ at the other.

The center tap is connected to what was the ground end of the input resistor R3, 22k Ω , and provides a variable bias voltage to the input transistors Q1 and Q5. As the potentiometer specified is a 15-turn unit, the bias adjustment is very smooth and easy to set.

This is basically the circuit that was used in the DH-220 adapted to the DH-200 to minimize effects on input impedance and overall performance. While the drawings and photos supplied with this article should allow you to build and install this mod without reference to DH-200 drawings or schematics, a copy of the manual is very handy. Complete manuals including schematics and part lists are available as free downloads from Hafler-Tech Support at the following URL: <http://www.hafler.com/techsupport/index.asp?1D=3>.

PHOTO 1: BALANCE BOARD, COMPONENT SIDE.

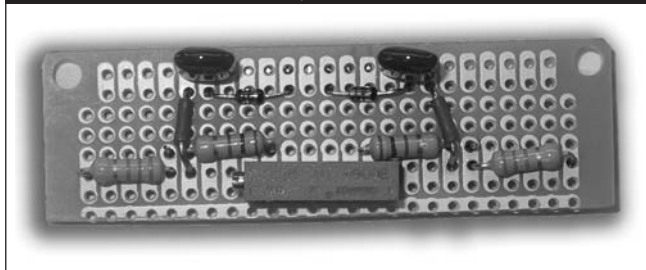


FIGURE 1: BALANCE CIRCUIT SCHEMATIC.

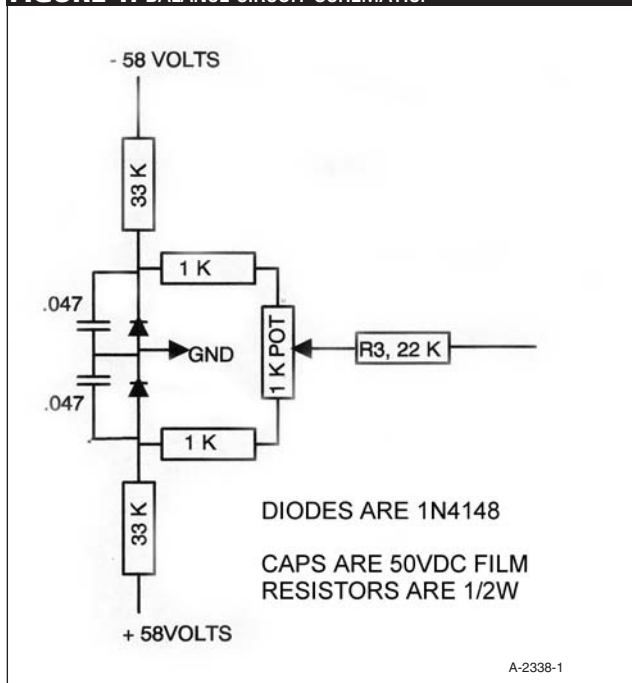
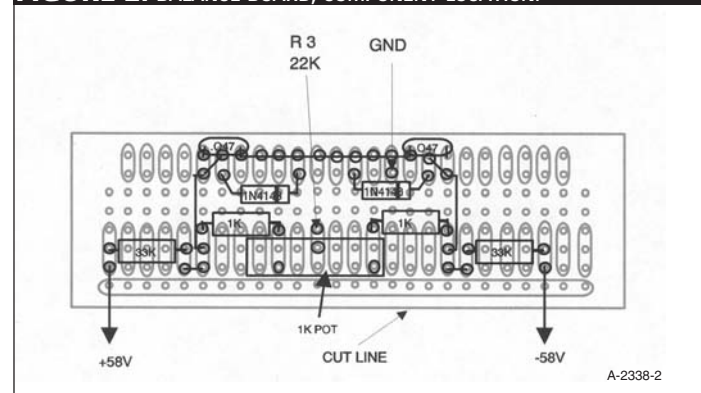


FIGURE 2: BALANCE BOARD, COMPONENT LOCATION.



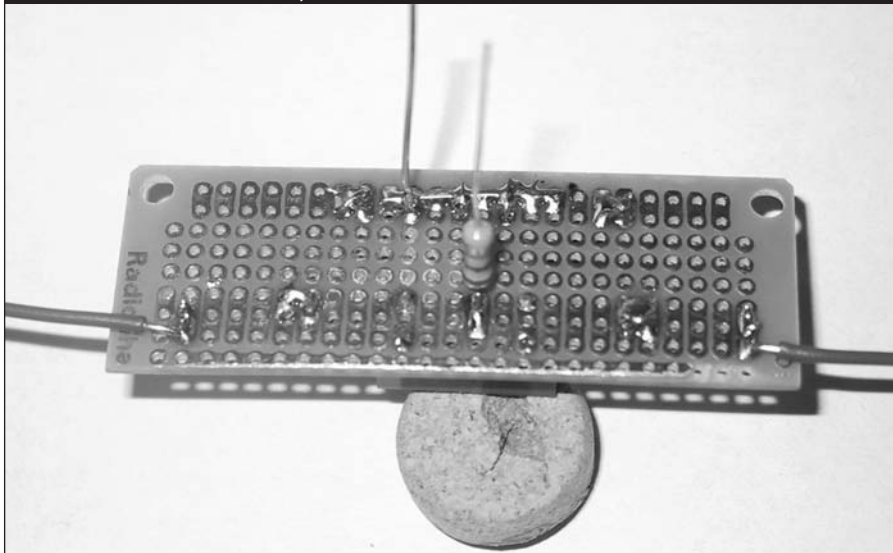
MOD CONSTRUCTION

Begin construction by cutting the Radio Shack circuit board in half so that you have two pieces similar to the board shown in *Fig. 2*. Smooth the cut edge and position the board as in *Fig. 2* with the foil side down. Use *Fig. 2* as a guide to populate the board and install the interconnecting jumpers as shown. Use the facing leads of the two 0.047 μ F caps to construct the long ground bus between them. Ensure that the bus is soldered to each pad it crosses.

I used solid 22-gauge wire for the remaining jumpers and the wiring to the main board. When installed, the balance board is held in place by this wiring. *Photo 1* shows the component side of the board.

Turn the board over and insert a 22k Ω , 1/2W resistor (R3), as shown in *Fig. 2*. Leave 1/8" to 3/16" clearance between the foil and the resistor body to facilitate soldering. Cut and strip about 2" of 22-gauge wire and insert it into the location labeled GND in *Fig. 2*. Cut two 3" long pieces of 22-gauge wire and strip 1/4" from one end of each. Insert the stripped ends of these wires into the

PHOTO 2: BALANCE BOARD, FOIL SIDE.



holes marked +58V and -58V in *Fig. 2*.

Photo 2 shows the foil side of a completed board ready to install. Inspect the board for sturdy solder joints, shorts, and so on, and ensure that all excess lead ends are clipped. Connect an ohmmeter between either end of the potentiometer and the center tap and adjust to read 500 Ω , centering the potentiometer. Repeat these steps for board #2.

Disconnect all input and output connections from the DH-200 and ensure it is unplugged from the wall outlet. Remove the eight screws holding the top cover and remove the cover. Remove the four screws holding the heatsink on the left. It makes no difference whether you are facing the front or back of the unit, just remove the screws from the heatsink to the bottom chassis.



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PHOTO 3: BALANCE BOARD INSTALLED.



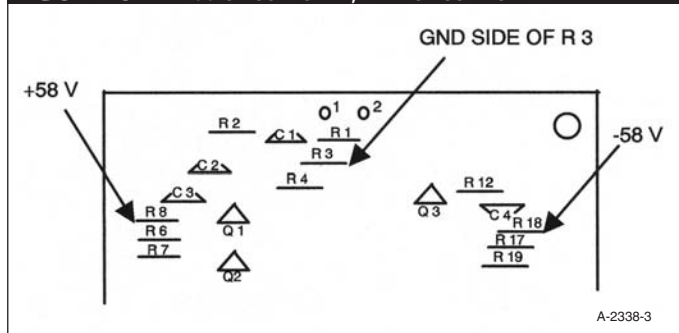
Fold the heatsink down away from the chassis. Remove the three screws holding the circuit board to the heatsink. There is a small insulating washer between the board and the heatsink on each screw. Do not lose the washers. You can fold the circuit board back toward the chassis exposing the foil side of the board. Using *Fig. 3*, locate R3, a 22k Ω 1/4W resistor.

Using a small iron and solder wick, remove R3 and clean up the mounting holes for R3. The leads of R3 are a bit

short to use that component, which is the reason to replace it. Position the balance board as shown in *Fig. 2*. Hold the DH-200 circuit board upright and insert the bare ground wire into the ground mounting hole for R3 and the free lead from the new R3 on the balance board into the remaining mounting hole for R3 on the DH-200 circuit board. Position the balance board parallel to the circuit board and about 1/8" above the top of C1 (*Photo 3*).

Solder the ground lead and the lead from the new R3 in place. Locate the ends of R8 and R18 marked +58V and

FIGURE 3: DH-200 CIRCUIT CARD, PARTS LOCATION.



short to use that component, which is the reason to replace it. Position the

-58V in *Fig. 3*. There will be enough free space between the circuit board and the bent leads to slip in a wire. Cut the + and - leads from the balance board to fit with a bend and strip the ends back about 3/16". Insert the ends in place and solder securely. Note that the component leads on the circuit board have been around a while, so a little cleanup may be required to secure a good joint. Check the wiring and re-attach the board to the heatsink, and do not forget the washers.

TESTING

The DH-200 can safely be run with the heatsink folded down, so you can see whether everything is set up correctly.

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You will need a voltmeter that can read down to at least 10mV (most digital meters will read to 1mV on the 2V range) and a small insulated screwdriver. Connect the voltmeter to the modified channel speaker terminals and set to a range that will read 100V DC (just in case). Do not connect anything to the input. Plug the power cord in and turn it on!

If all is well adjust the voltmeter to obtain a reading, probably below 1V. Adjust the balance potentiometer to obtain a reading of less than 10mV. Note that adjusting the pot applies a step voltage to the input and causes a rather large initial change on the output, so allow the reading to settle and keep the adjustments slow. When all is well turn the DH-200 off, disconnect the line cord from the wall, and disconnect the meter. Re-attach the heatsink to the chassis and repeat the preceding for the remaining channel.

If you are unsure of the bias setting for each channel, this is a good time to check. There are two dual fuse blocks on the chassis floor set between the circuit boards and the power transformer. The fuses for the positive 60V supplies to each channel (F2L and F2R) are the ones closest to the power transformer. The output side of the fuses go to terminal 3 or 4 of each circuit card. This adjustment is done with both the input connectors and the speaker terminals open.

Make sure the line cord is unplugged; remove F2 from the fuse block of the channel being checked and connect an ammeter across the empty fuse block. Set the ammeter to read 1A and turn the DH-200 on. Let it warm up for a few minutes and adjust potentiometer P1, which is near the center of the board, for a reading of 275mA.

Turn off the power and allow the power supply to discharge until the ammeter reads zero. This may take a while as there are no bleeders on the DH-200 power supply. Replace the fuse and repeat for the other channel as required. If the bias is off by more than 10%, you should recheck the balance and touch up as needed. Replace the cover and your Hafler should be ready to go.

If you have not done the standard power-supply mod, it is simple and easy to perform and improves the high-frequency definition. Shunt each

10,000 μ F filter cap with a good 2.2 μ F polypropylene cap and a 47k Ω 1/2W resistor. The original filter caps have a bit of inductance. The 2.2 μ F cap takes care of the inductance and the resistor is a bleeder for the power supply. Enjoy the music. aX

PARTS LIST

Component	Quantity	Description	Source
Potentiometer	2	1k Ω , 15 turn	Radio Shack 271-342
Capacitor	4	0.047 μ F, 50V DC, polyester film	Radio Shack 272-1068
Diode, switching signal	4	1N4148	Radio Shack 276-1122
Resistor	4	33k Ω , 1/2W	Radio Shack 271-1129
Resistor	2	22k Ω , 1/2W	Radio Shack 271-1128
Resistor	4	1k Ω , 1/2W	Radio Shack 271-1118
Grid syle PC board	1 each		Radio Shack 276-150
About 1' of #22 gauge solid wire, insulated			

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